# VISALIA POLE YARD
# REMEDIAL ACTION PLAN
# CONSTRUCTION COMPLETION REPORT

## SOUTHERN CALIFORNIA EDISON VISALIA POLE YARD
## VISALIA, CALIFORNIA

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Prepared By:

G. M. Becker
Sr. Environmental Specialist

C. L. Eaker
Sr. Environmental Engineer

T. C. Sciarrotta
Sr. Research Scientist

R. S. Weidner
CEG 1180
Sr. Engineering Geologist

REGISTERED GEOLOGIST
RANDALL S. WEIDNER
No. 1180
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

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## TABLE OF CONTENTS

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## INTRODUCTION

This report documents the implementation of the remedial elements outlined in the Southern California Edison Visalia Pole Yard (VPY) Remedial Design (RD), submitted to the California EPA Department of Toxic Substances Control (DTSC) in December 1999.

The VPY RD was approved by DTSC in April 2000. It was developed based on: 1) the results of the Visalia Steam Remediation Project, which removed the equivalent of over 160,000 gallons of pole-treating chemicals (PTCs) over a 3-year period, and; 2) the general concepts of the original approved site Remedial Action Plan (RAP)/Record Of Decision (ROD).

The RD called for enhanced biological degradation of remaining PTCs, coupled with continued pump-and-treat. The enhanced biological degradation is facilitated through the introduction of oxygen into both the unsaturated and saturated zones at the site, within the area bounded by the former steam remediation well system (refer to the discussion of the steam remediation project included in the RD). The pump-and-treat system incorporates a number of ground-water extraction wells coupled with a multi-component separation and filtration treatment plant. The general site configuration is shown in Figure 1, Site Layout.

## ENHANCED BIODEGRADATION

The following sections describe the systems constructed at the site to implement the enhanced biodegradation component of site remediation. The various systems are tailored to the site stratigraphy, which is illustrated in Figure 2, Generalized Hydrostratigraphy. These systems target the following specific hydrostratigraphic zones:

- Vadose Zone & Shallow Aquifer (unsaturated zone)
- 60' Sand
- Intermediate Aquifer
- Deeper Aquifer

The oxygen introduction systems are designed to: 1) inject low volumes of air into unsaturated soil zones to enhance biodegradation by native hydrocarbonutilizing bacteria, known as "bioventing" and; 2) introduce sparged air into saturated aquifers to enhance dissolved oxygen in the ground water. Elevated dissolved oxygen in ground water will both enhance degradation by bacteria, as well as enhance chemical oxidation of the PTCs.

## BIOVENTING AIR INJECTION SYSTEM

Oxygen is introduced into the unsaturated subsurface via two 1.5-horsepower (hp) blowers. Their locations are shown on Figure 3, Unsaturated Zone Bioventing System. One blower is connected to injection wells S-14S (shallow) and S-15S (shallow). The other blower is connected to injection wells VSB-1 and S-13S (shallow). Well VSB-1 oxygenates the "Vadose Zone" (Figure 2), in the previously identified (localized) source area. The three remaining wells oxygenate the "Shallow Aquifer".

Each bioventing well is fitted with a gate valve and flow meter. Prior to blower start-up, pressure gauges were fitted to the outer ring of steam injection wells. Zero pressure readings were verified before turning on the blowers. With the blowers on, the gate valves were slowly opened until approximately 0.1 inches (water) of pressure was observed at the outer wells. Proper airflow rates were noted, and are continuously maintained.

### Soil Gas Monitoring Points

Soil gas monitoring points have been installed in a number of the shallow wells to monitor soil pressures and/or soil gas concentrations. These include the former shallow steam injection wells S-3S through S-11S, and former shallow steam extraction wells S-12S through S-15S. The configuration of these wells, designated as "Bioventing Monitoring Wells", is shown on Figure 3. All wells are fitted with copper tubing extending from the well flange to a depth of approximately 40 feet. The surface end of the tubing is fitted with a valve to prevent interaction with the atmosphere between sampling periods. The monitoring point is located within the screened portion of the well, in the approximate middle of the "shallow aquifer".

The former shallow injection wells can be utilized for: 1) determining proper injection volume to maximize bioventing by measuring gas pressure or oxygen levels; or, 2) monitoring biodegradation respiration rates through measurement of oxygen/carbon dioxide trends.

The former shallow extraction wells are monitored for biodegradation respiration rates only, since they are utilized for air injection.

Air pressures are monitored utilizing a manometer gauge, with a range of 0-1" of water. Soil gas concentrations are monitored with a RKI Instruments, Eagle

Model portable gas analyzer. The Eagle analyzer has sensors with ranges of 0-25% for oxygen, and 0-5,000 parts per million for carbon dioxide.

To date, several rounds of monitoring for biodegradation respiration have been inconclusive. This is likely due to the elevated temperatures still being measured in the "shallow aquifer" zone. Temperatures in this zone are still near 70° centigrade, which is at or above the temperature where native bacteria are active.

**Soil Temperature Monitoring System**

Soil temperatures are currently monitored weekly, utilizing the thermocouple strings associated with the Electrical Resistance Tomography (ERT) system that was used during steam remediation. Five specific ERT strings are monitored. They are ERT-1 through ERT-5 which are located generally in the middle of the site; their locations are shown on Figure 1. Since the temperature monitoring system was designed to operate only during the life of the steam remediation project, and the information is of limited value, it will be used only as long as it remains operable.

**BIOSPARGING SYSTEM**

A ground water sparging system has been placed in a number of existing wells to provide additional oxygen for bioremediation. Based on a comprehensive biotreatability study conducted by The Center for Environmental Microbiology (Frankenberger, 1995), oxygen is the most effective agent for degrading the PTCs. These wells are screened in the following hydrostratigraphic units:

- 60' Sand
- Intermediate Aquifer
- Deeper Aquifer

The spargers were designed and constructed by KV Associates. Depending on the specific well conditions, they vary from five to ten feet in length, with a diameter of 1-5/8-inches or 2-inches. Each sparger is connected to a ¾-inch riser pipe that is connected to the surface flange of the well. All spargers are connected to a header system with flexible air hoses. Individual flow valves are located at each well. The air source is a fifty horsepower Gardner-Denver air compressor rated at 125 pounds per square inch (psi).

**Sixty Foot Sand Sparge Wells**

The former shallow aquifer steam injection wells are screened across the sixty-foot sand. They are generally arrayed around the boundaries of the area containing residual pole-treating chemicals. Figure 4, 60-Foot Sand

Biosparging System, shows the well locations. Wells S6-S, S7-S, S9-S, S10-S, S11-S, S12-S and S13-S have 2-inch diameter spargers, extending from the depth of 65-70 feet.

### Intermediate Aquifer Sparge Wells

The former intermediate aquifer steam injection wells are screened across that aquifer, from eighty to one hundred feet below grade. The wells are generally arrayed around the boundaries of the area containing residual pole-treating chemicals. Figure 5, Intermediate Aquifer Biosparging System, shows the well locations. Wells S6-I, S7-I, S8-I, S12-I and S13-I have 2-inch diameter spargers, extending from the depth of 90-100 feet. Due to well screen plugging during steam remediation, the sparger in well S12-I extends only from 72-82 feet. Wells S9-I and S11-I required 2-inch diameter screen inserts during steam remediation. They are fitted with 1-5/8-inch diameter spargers, extending from 90-100 feet deep.

### Deeper Aquifer Sparge Wells

Two of the three former steam injection/extraction wells, S14-D and S15-D, have been fitted with spargers. These wells are screened from a depth of 125 to 145 feet, in approximately the upper third of the "Deeper" aquifer. They have 2-inch diameter spargers extending from 125-135 feet. Their locations are shown on Figure 6, Deeper Aquifer Biosparging System.

## GROUND WATER PUMP-AND-TREAT SYSTEM

The following sections describe the ground water pumping scheme employed at the site, and the water treatment and discharge system that removes PTCs from the extracted water.

### GROUND WATER PUMPING

Continuous ground water pumping is maintained in the 60-Foot Sand and both the Intermediate and Deeper aquifers, in order to maintain hydraulic control of the residual dissolved PTCs.

### Sixty Foot Sand

Hydraulic control of the 60-Foot Sand can be maintained through pumping of wells EW-2, EW-3, and EW-4. These wells are screened from 60-100 feet below grade. Figure 7, Ground Water Extraction Well System, shows the well locations.

**Intermediate Aquifer**

Hydraulic control of the intermediate aquifer is maintained through pumping of any of a combination of wells. These include EW-1, EW-2, EW-3, EW-4, S14-I, and S15-I. Their locations are shown on Figure 7.

The total pumping rate considers two factors: 1) hydraulic control on the basis of aquifer transmissivity, and; 2) over-pumping of the intermediate aquifer to promote leakance from the underlying "Deeper" aquifer. An upward hydraulic gradient helps prevent movement of any residual denser-than-water PTCs into the lower aquifer.

Based on a 5-day Intermediate Aquifer pump test in November 2000 (Envirologic Resources, Inc., 2001), the post-steam remediation transmissivity has increased approximately 30 percent. The aquifer test conducted during the Remedial Investigation (RI) indicated a transmissivity of approximately 50,000 gallons per day per foot. It has increased to approximately 65,000 gallons per day per foot, following steam remediation. The Intermediate Aquifer is currently being pumped a total of approximately 125 gallons per minute, to promote both horizontal and vertical hydraulic control. The westernmost well, EW-4, is pumping at approximately 50 gallons per minute. Based on calculations of the capture limit for this well alone, it extends beyond the site boundary to the middle of Ben Maddox Way.

**Deeper Aquifer**

Hydraulic control of the Deeper Aquifer is maintained through pumping of well S9-D, shown on Figure 7. The November 2000 pump test of the Deeper Aquifer (Envirologic Resources, Inc., 2001) resulted in a transmissivity of approximately 75,000 gallons per day per foot. The current pumping rate is approximately 100 gallons per minute. This results in a calculated capture limit extending to the west property line.

**WATER TREATMENT PLANT**

The existing water treatment plant is capable of both manual and computer-automated operation. This system is composed of the following treatment technologies:

- Gravity separation
- Dissolved-air flotation separation
- Dual-media filtration
- Cartridge-filtration
- Granular Activated Carbon filtration

The entire water treatment plant is surrounded by a containment structure to prevent the release of untreated water in the event of a vessel or piping rupture. Any leaked water will drain to a sump where it will be pumped back into the head-works of the treatment system. In the event of a large water release, where the containment might be filled to overflowing, there is a float switch that will turn the pumping system off. A schematic diagram of the plant process flow is shown in Figure 8.

Following treatment, the filtered water is discharged to the City of Visalia under an industrial sewer permit.

**Computer Operating System**

The water treatment plant currently runs continuously, with or without an operator, utilizing Intellution's FIX® software. The operating computer continuously monitors system flows, vessel water levels, and differential pressure in each of the filtration sub-systems. The operating system also incorporates an automated voice-messaging alert system, utilized during unmanned periods, which will call operators whenever system parameters are out-of-specification. The system will call, in order, the pre-designated phone number for each of the plant operators, and responsible Edison personnel. The system requires a pre-determined response from the call recipient. If the proper response is not received, the system will continue on to the next designated number. All plant operators and responsible Edison personnel are capable of remotely accessing the operating system, via computer, to assess system parameters. System problems can be identified and operating changes made to bring the plant back into proper operation. Alternatively, the entire system can be shut down until personnel arrive at the site.

**Treated Water Discharge**

The plant removes pole-treating chemicals from the extracted ground water to below detectable concentrations. Treated water is discharged to the City of Visalia industrial sewer system, under an Industrial Discharge Permit (IDP). The permit requires monthly, semi-annual, and annual monitoring of various chemicals and other operating parameters.

The City of Visalia IDP requires monthly monitoring of the following:

- pH
- Turbidity
- Temperature
- Total discharge volume
- Pentachlorophenol
- Total PAH's

- TCDD equivalents

The IDP requires semi-annual monitoring of the following:

- Certification of the outfall flow meter

The IDP requires annual:

- pH
- Oil & grease
- Biological Oxygen Demand
- Total suspended solids
- Semi-volatile organic compounds
- Volatile organic compounds
- Metals
- Total cyanide
- Designation of responsible personnel
- Certification of operation in accordance with an Operations & Maintenance Plan
- Renewal of the permit

**GROUND WATER MONITORING**

Ground water monitoring for pole-treating chemicals is conducted on-site and in the vicinity of the site on a quarterly basis. Both the Intermediate and Deeper aquifers are monitored. The current monitoring network is shown on Figures 9, Intermediate-Aquifer Monitoring-Well Network, and Figure 10, Deeper-Aquifer Monitoring-Well Network. The off-site monitoring wells have different sampling schedules based on their location with respect to ground-water flow direction. Those wells down-gradient from the site are monitored quarterly, whereas those located side-gradient and up-gradient are monitored less frequently. The current DTSC-approved monitoring schedule is included in Table 1.

**Pole-Treating Chemicals Monitored**

The pole-treating chemicals analyzed include Total Petroleum Hydrocarbons as diesel (TPH-Diesel), semi-volatile organics, and dioxins/furans. TPH-diesel is analyzed by EPA Method 8015-M; semi-volatile organics are analyzed by EPA Method 525.2, and; dioxins/furans are analyzed by EPA Method 8280. A list of the specific chemical species analyzed in the semi-volatile organics and dioxins/furans, is included in Table 2. Also included are the sample detection limits; and for the dioxins/furans, the toxicity equivalency factors.

**Other Parameters**

During quarterly monitoring, the following field parameters are also being tested:

- Temperature (Fahrenheit)
- pH
- Dissolved oxygen (DO)
- Oxidation-reduction potential (ORP)

This data will be utilized to evaluate biodegradation factors in the aquifers being monitored.

# REFERENCES


1. Southern California Edison Company, "Remedial Design, Visalia Steam Remediation Project", report to agencies, dated December 15, 1999.

2. Frankenberger, W. T., 1995, "Bioremediation of PAHs and PCP at the SCE Visalia Pole Yard, A Treatability Study", prepared by Center for Environmental Microbiology; consultant report to Southern California Edison Company, dated September 1995.

3. Envirologic Resources, Inc., "Aquifer Testing 2000, Southern California Edison Visalia Pole Yard (Draft)"; consultant report dated June 15, 2001.

# TABLES

# TABLE 1

## GROUND WATER MONITORING SCHEDULE

| WELL | AQUIFER | ANALYTES/DEPTH | | | | |
|---|---|---|---|---|---|---|
| | | PCP | CREOSOTE | DIOXINS/FURANS | TPH | DEPTH |
| EW-1 | I | Q | Q | Q | Q | M |
| EW-2 | I | Q | Q | Q | Q | M |
| EW-3 | I | Q | Q | Q | Q | M |
| EW-4 | I | Q | Q | Q | Q | M |
| MW-25 | I | A | A | A | A | M |
| MW-26 | I | - | - | - | - | M |
| MW-35 | I | - | - | - | - | M |
| MW-37 | I | Q | Q | Q | Q | M |
| MW-39 | I | - | - | - | - | M |
| MW-47 | I | A | A | A | A | M |
| MW-49 | I | - | - | - | - | M |
| S-14I | I | Q | Q | Q | Q | M |
| S-15I | I | Q | Q | Q | Q | M |
| MW-38 | D | Q | Q | Q | Q | M |
| MW-40 | D | A | A | A | A | M |
| S-9D | D | Q | Q | Q | Q | M |
| S-14D | D | Q | Q | Q | Q | M |
| S-15D | D | Q | Q | Q | Q | M |
| I-Intermediate Aquifer<br>D-Deeper Aquifer | | M-Monthly<br>Q-Quarterly<br>A-Annually | | | | |

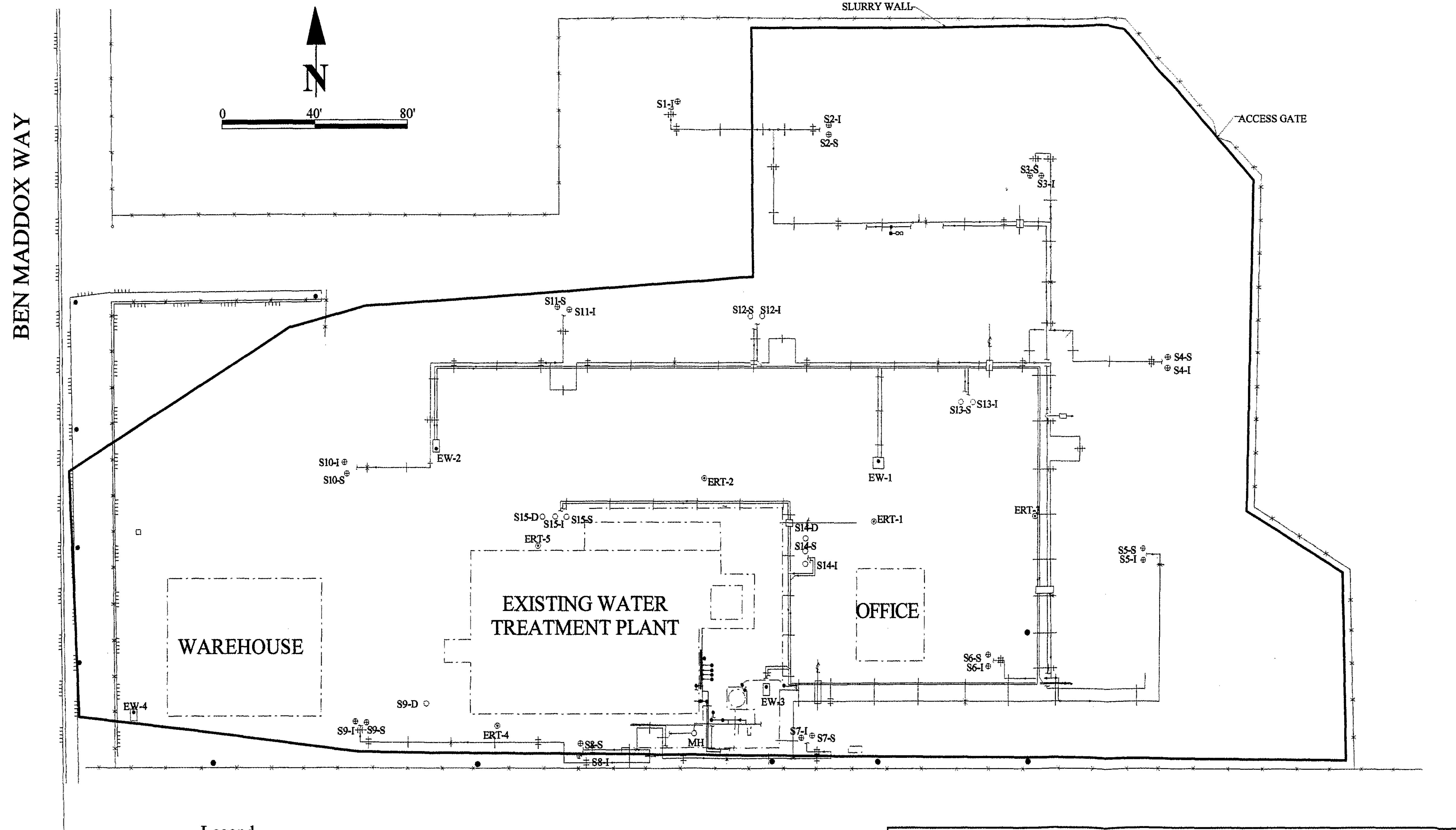
# TABLE 2

## SPECIFIC GROUND WATER ANALYTES

| ANALYTE | DETECTION LIMIT | TEF* |
|---|---|---|
| **Total Petroleum Hydrocarbons** | | |
| TPH-Diesel | 50 ug/l | - |
| **Polynuclear Aromatic Hydrocarbons** | | |
| Naphthalene | 1.0 ug/l | - |
| 2-Methylnaphthalene | 1.0 | - |
| 1-Methylnaphthalene | 1.0 | - |
| Acenaphthylene | 1.0 | - |
| Acenaphthene | 1.0 | - |
| Fluorene | 1.0 | - |
| Phenanthrene | 1.0 | - |
| Anthracene | 1.0 | - |
| Fluoranthene | 1.0 | - |
| Pyrene | 1.0 | - |
| Benzo(a)Anthracene | 1.0 | - |
| Chrysene | 1.0 | - |
| Benzo(b)Fluoranthene | 1.0 | - |
| Benzo(k)Fluoranthene | 1.0 | - |
| Benzo(a)Pyrene | 0.2 | - |
| Indeno(1,2,3-c,d)Pyrene | 1.0 | - |
| Dibenz(a,h)Anthracene | 1.0 | - |
| Benzo(g,h,i)Perylene | 1.0 | - |
| **Chlorophenols** | | |
| Pentachlorophenol | 1.0 ug/l | - |
| **Dioxins/Furans** | | |
| 2,3,7,8-TCDD | <0.5 ng/l** | 1.000 |
| Total TCDD | <0.5 | 0.0 |
| 1,2,3,7,8-PeCDD | <5.0 | 0.500 |
| Total PeCDD | <3.0 | 0.0 |
| 1,2,3,4,7,8-HxCDD | <1.0 | 0.100 |
| 1,2,3,6,7,8-HxCDD | <1.0 | 0.100 |
| 1,2,3,7,8,9-HxCDD | <1.0 | 0.100 |
| Total HxCDD | <1.0 | 0.0 |
| 1,2,3,4,6,7,8-HpCDD | <2.0 | 0.010 |
| Total HpCDD | <2.0 | 0.0 |
| OCDD | <5.0 | 0.001 |
| 2,3,7,8-TCDF | <1.0 | 0.100 |
| Total TCDF | <1.0 | 0.0 |
| 1,2,3,7,8-PeCDF | <2.0 | 0.050 |
| 2,3,4,7,8-PeCDF | <2.0 | 0.500 |
| Total PeCDF | <2.0 | 0.0 |
| 1,2,3,4,7,8-HxCDF | <2.0 | 0.100 |
| 1,2,3,6,7,8-HxCDF | <2.0 | 0.100 |
| 2,3,4,6,7,8-HxCDF | <2.0 | 0.100 |
| 1,2,3,7,8,9-HxCDF | <2.0 | 0.100 |
| Total HxCDF | <2.0 | 0.0 |
| 1,2,3,4,7,8,9-HpCDF | <2.0 | 0.010 |
| 1,2,3,4,7,8,9-HpCDF | <2.0 | 0.010 |
| Total HpCDF | <2.0 | 0.0 |
| OCDF | <2.0 | 0.001 |

Notes: * Toxicity Equivalency Factor.
** Detection limits are typically variable.

# FIGURES




## Legend

- Ground Water Extraction Well
- Steam Project Injection Well
- Steam Project Extraction Well
- ERT / Thermocouple Well

# SITE LAYOUT

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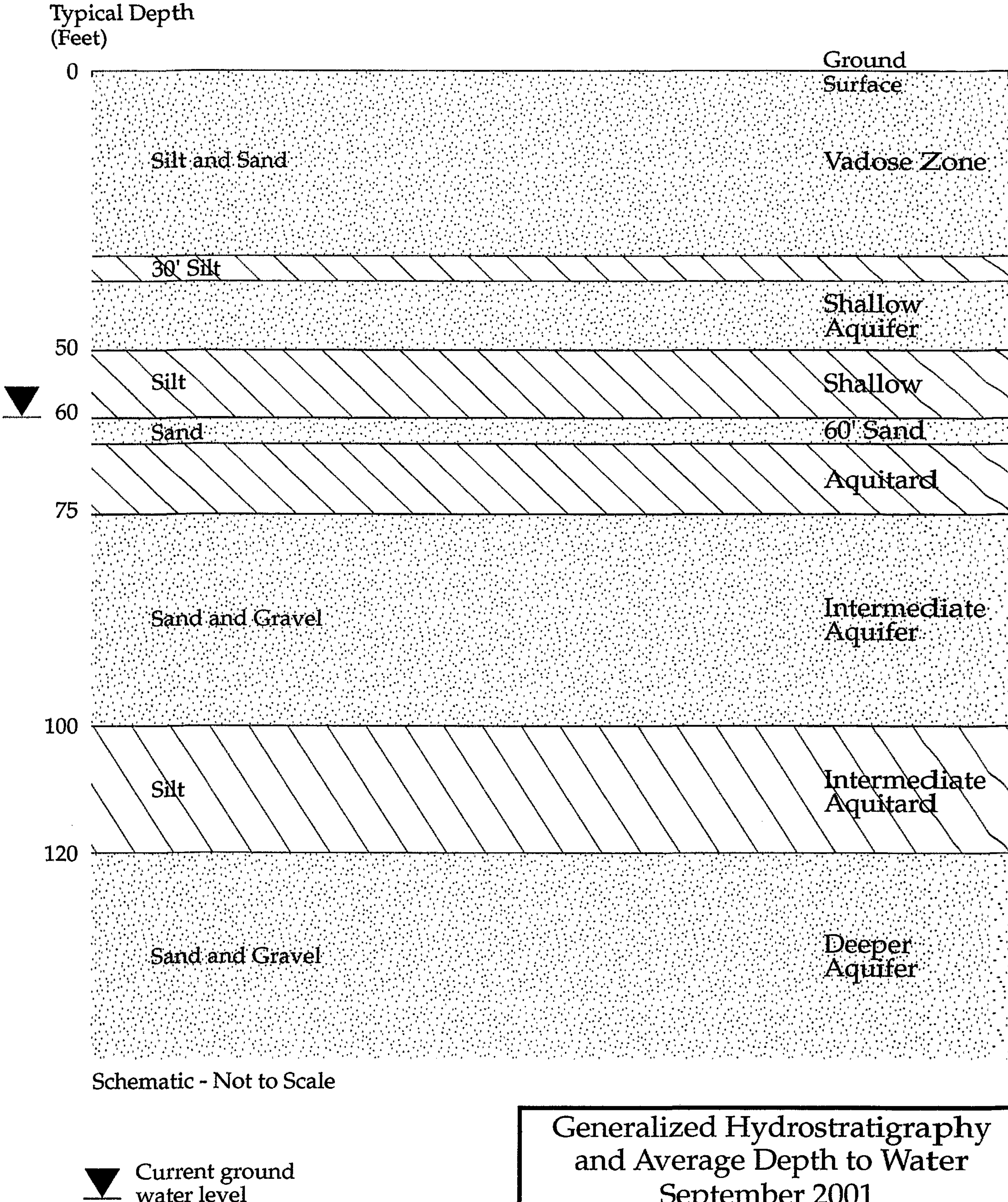
FIGURE 1




Generalized Hydrostratigraphy and Average Depth to Water September 2001

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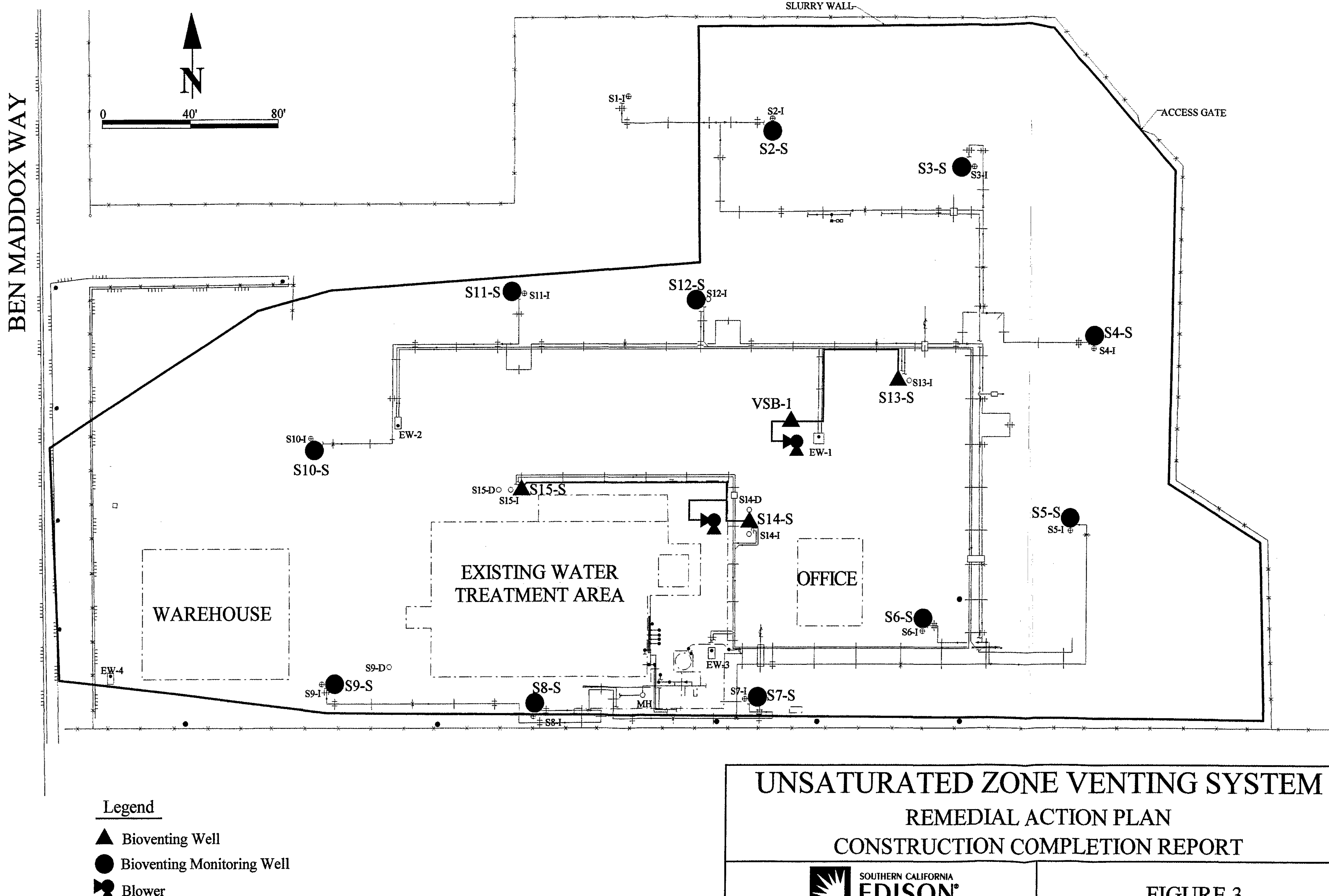
Figure 2




# UNSATURATED ZONE VENTING SYSTEM

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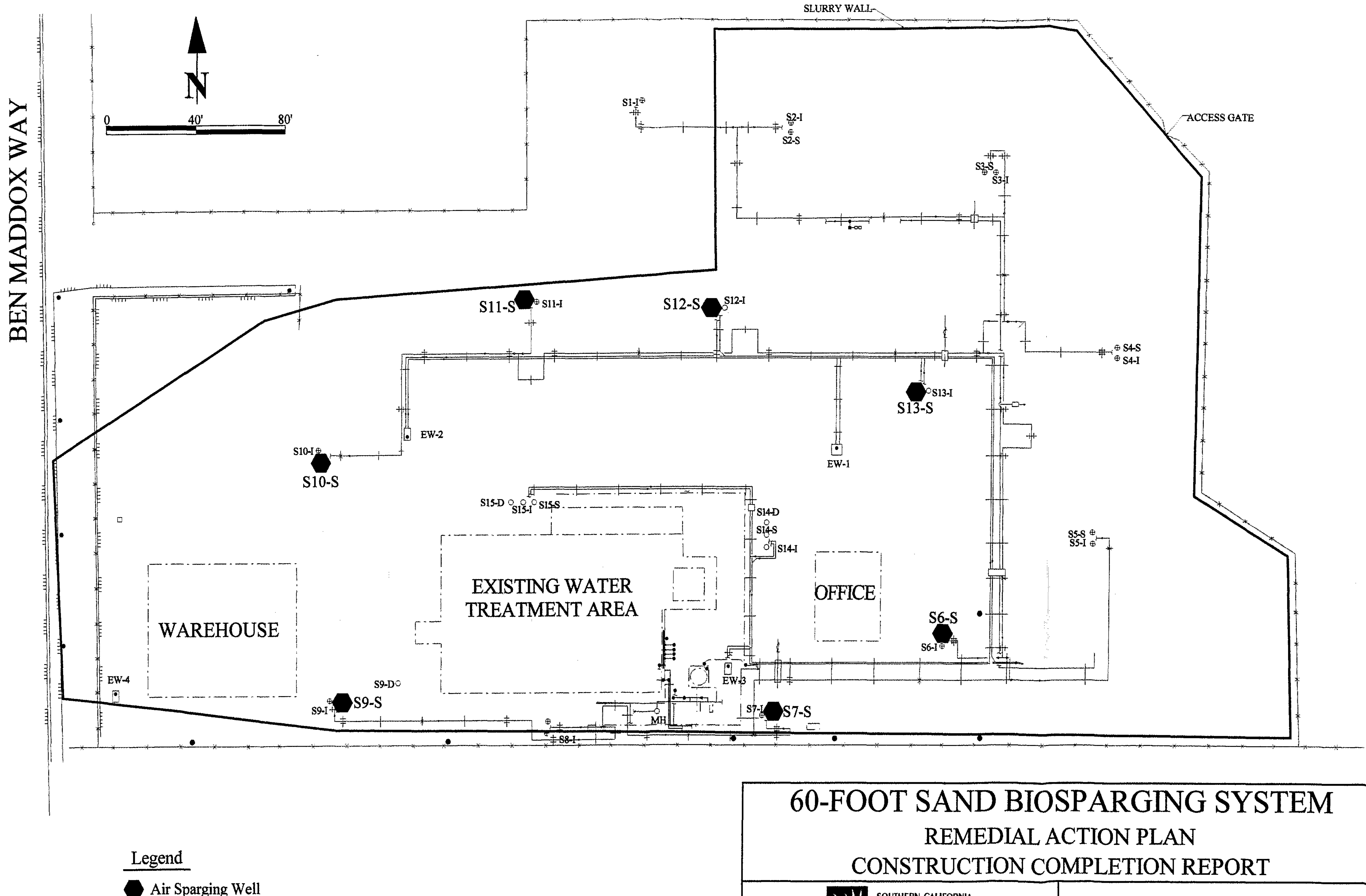
FIGURE 3




# 60-FOOT SAND BIOSPARGING SYSTEM

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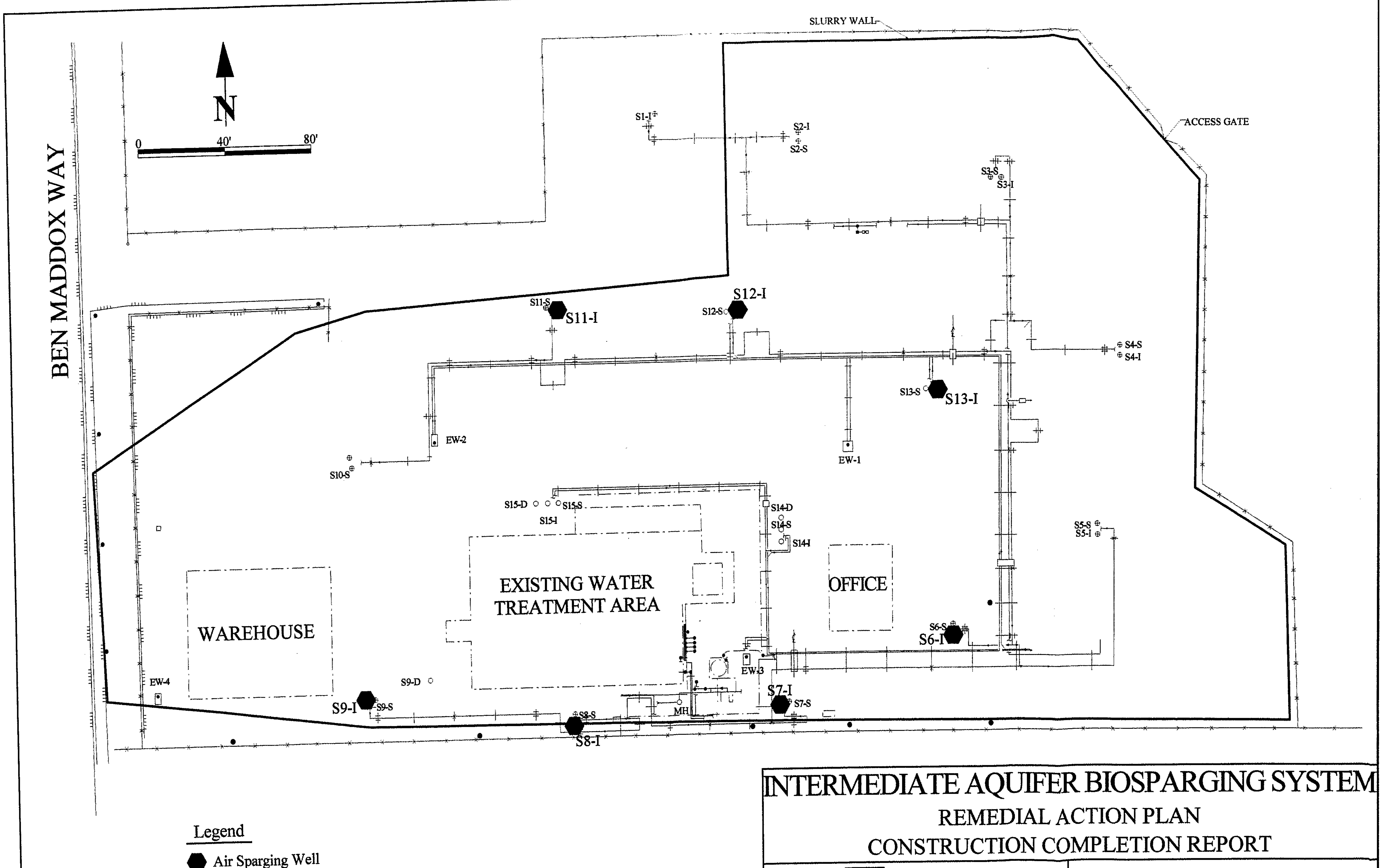
FIGURE 4




# INTERMEDIATE AQUIFER BIOSPARGING SYSTEM

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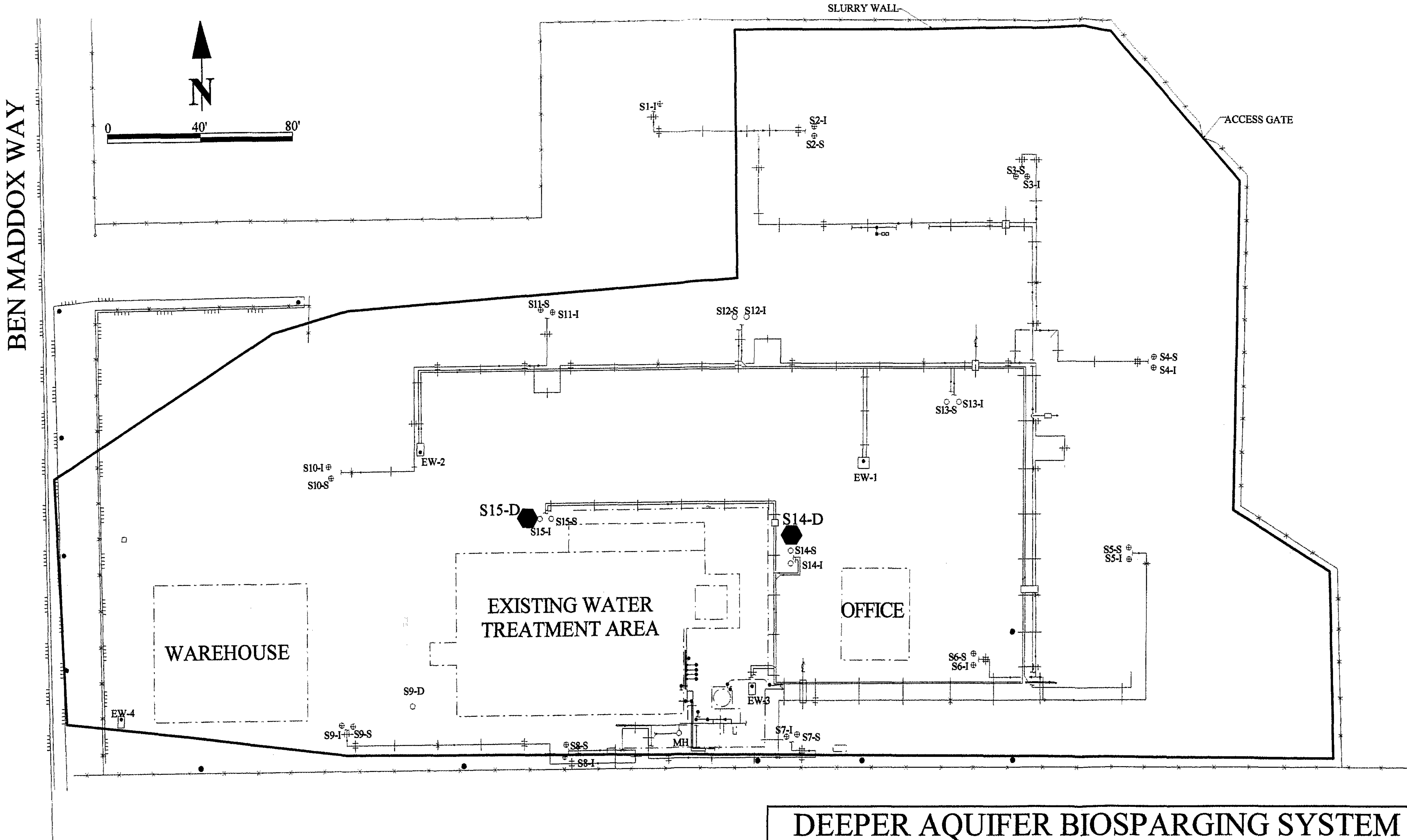
FIGURE 5




Legend

Air Sparging Well

# DEEPER AQUIFER BIOSPARGING SYSTEM

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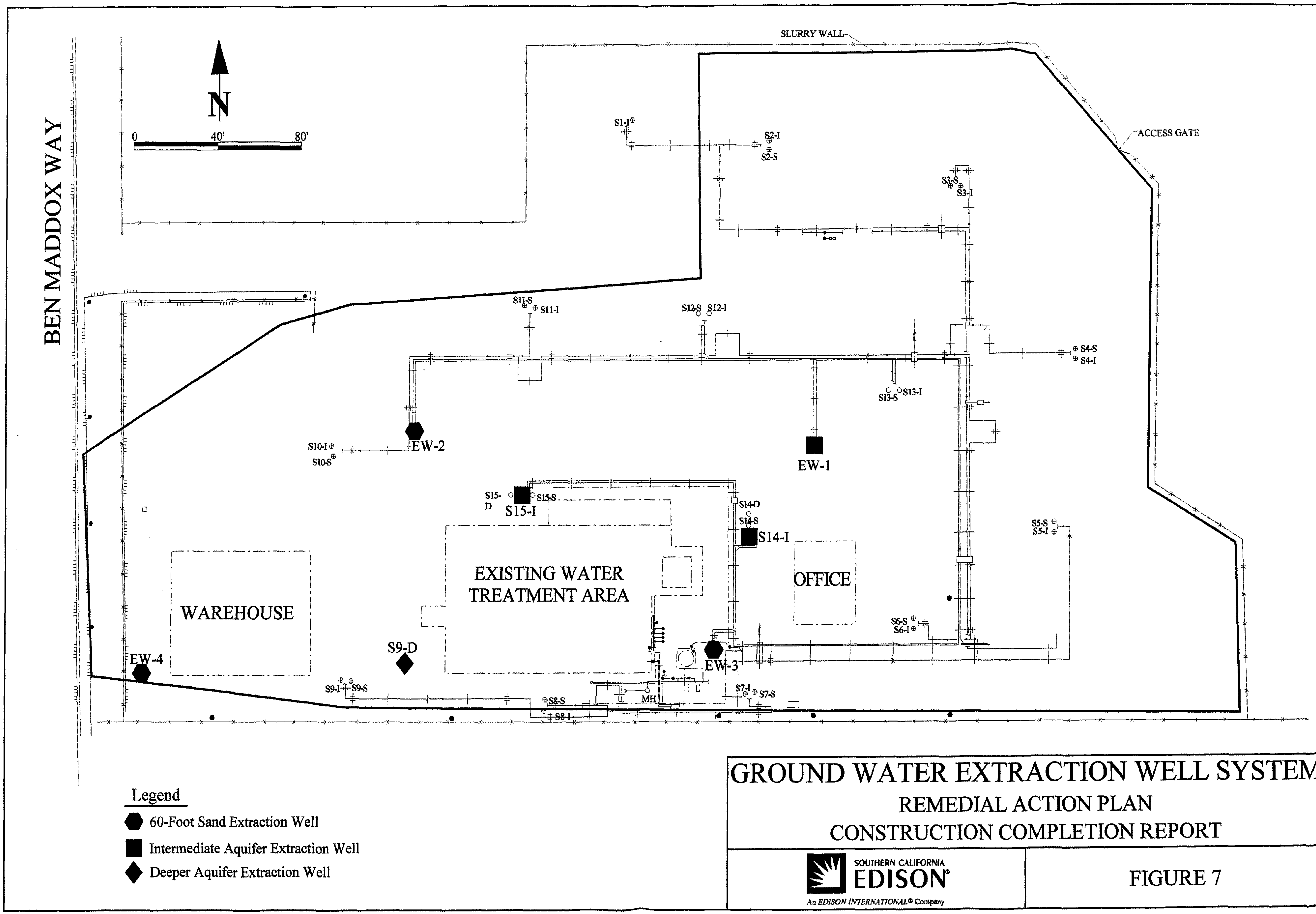
FIGURE 6




# GROUND WATER EXTRACTION WELL SYSTEM

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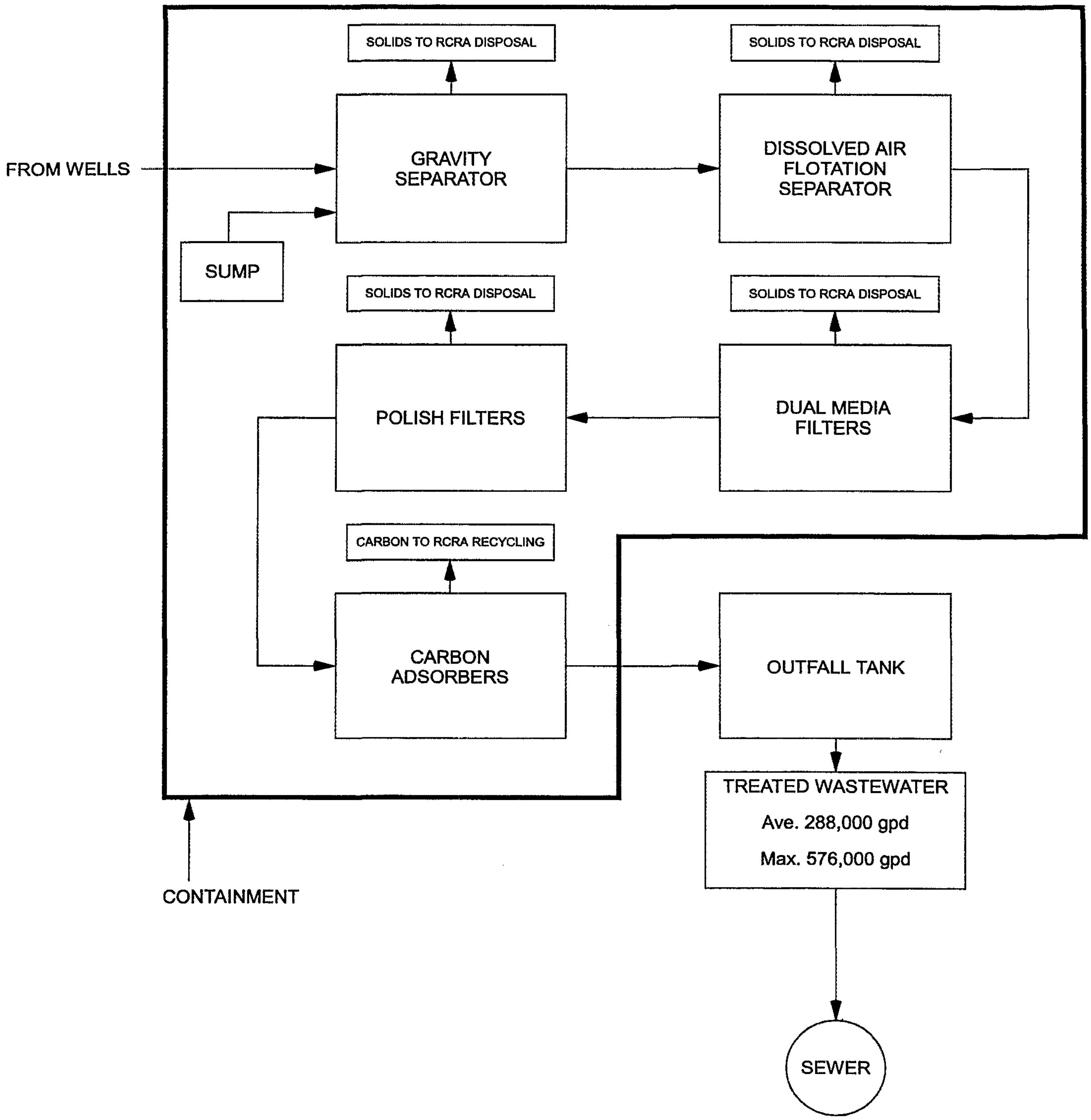
FIGURE 7

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WATER TREATMENT PROCESS FLOW

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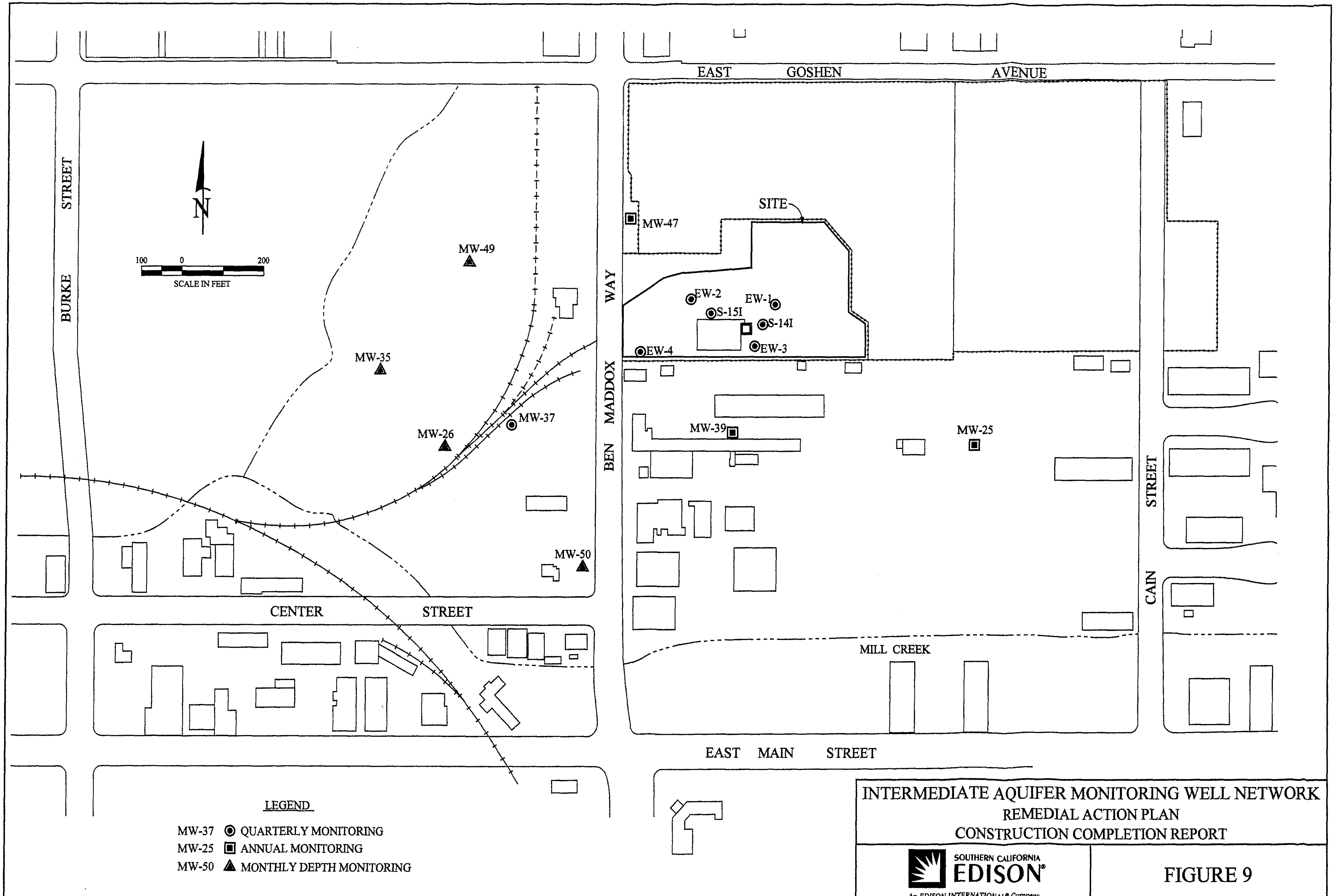
FIGURE 8




INTERMEDIATE AQUIFER MONITORING WELL NETWORK
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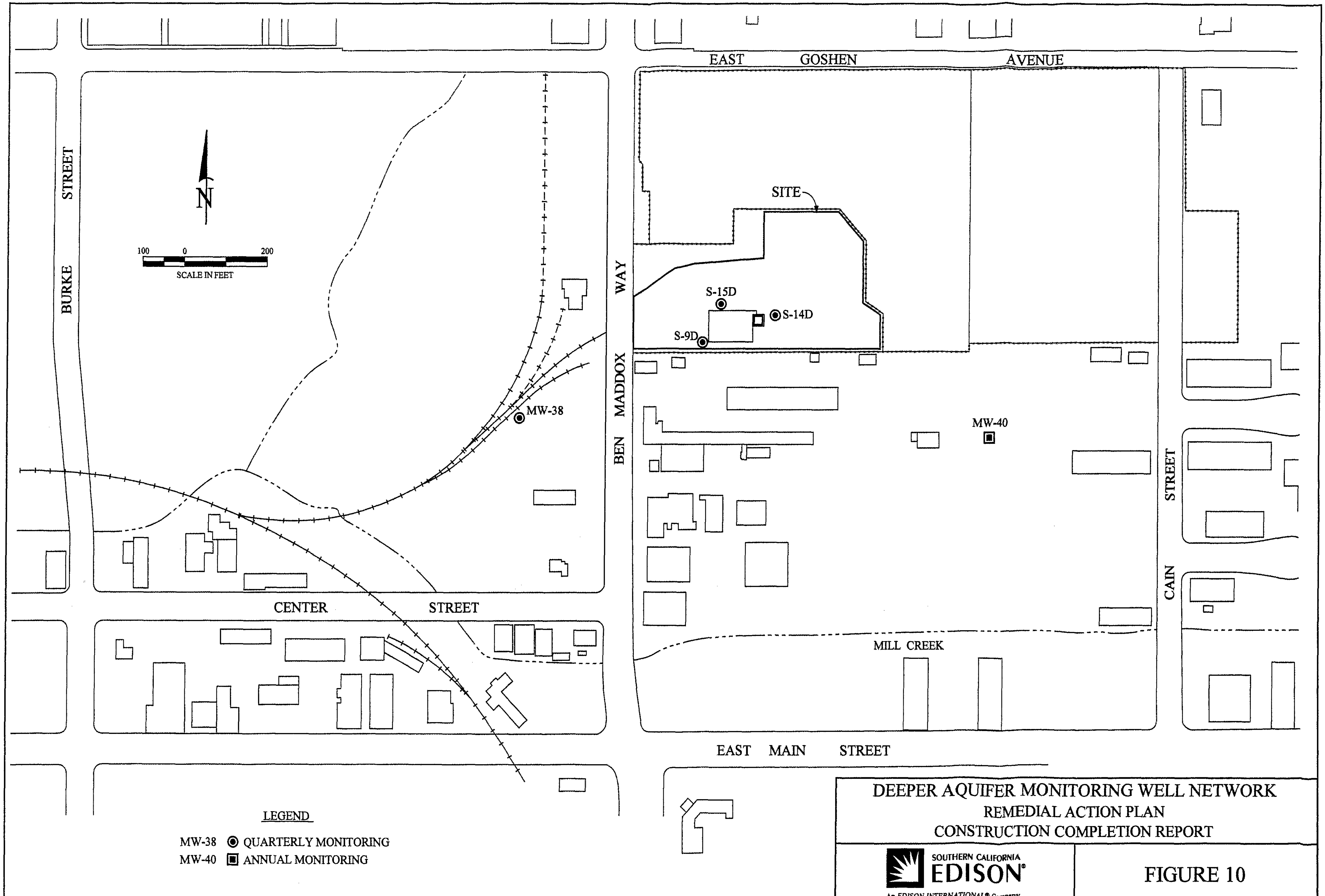
FIGURE 9




DEEPER AQUIFER MONITORING WELL NETWORK
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FIGURE 10